FUNCTIONAL DEFINITION DOCUMENT

NETRONIC Visual Scheduling

Evaluation Control Add-in

for Microsoft Dynamics 365 Business Central

Version: **1.0** | as of 18 March 2019

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1 Scope of Document

The purpose of this document is to outline the functional definition of the NETRONIC Visual Scheduling Evaluation Control Add-in for Microsoft Dynamics 365 Business Central that NETRONIC has developed. This client control add-in is based on HTML5/JavaScript technology and will be called VSE for short.

The FDD is complemented by the IDD (Interface Definition Document), in which NETRONIC specifies the bespoke interface of the VSE. The IDD specifies all objects, events and functions that a developer can use to integrate and work with the VSE within Microsoft Dynamics 365 Business Central.

2 Purpose of VSE: MVP for ISV solutions

NETRONIC provides the VSE as a client control add-in for evaluation purposes only. In regards to the VSE, "evaluation" is referred to the evaluation by a Dynamics 365 Business Central / AL developer. "Evaluation" is **not** referred to the evaluation by a Business Central user. It is explicitly mentioned that this is no ready-to-use add-in such as e.g. the standard Visual Production Scheduler add-in developed from NETRONIC for standard NAV / Business Central.

The purpose of the VSE is to enable Business Central developers to easily create a minimum viable product (MVP) of *their* visual scheduler as part of *their* ISV solution. Hence, the VSE is a developer tool for Business Central ISVs.

3 Technology & Architecture

3.1 Technology

The VSE is implemented as JavaScript client control add-in for Microsoft Dynamics 365 Business Central using the NETRONIC Web Application Framework (NWAF), which enables NETRONIC to effectively develop visual scheduling applications based on HTML5/JavaScript technology. This technological foundation has three implications:

- The usage of HTML5/JavaScript technology allows using the VSE in any of the Microsoft Dynamics 365 Business Central Clients – namely the Windows Client, the Web Client, the Tablet Client and the Smartphone Client. As a visual scheduling application by its nature it always requires a comparably large screen with high resolution, it is not recommended to use the VSE with the Dynamics 365 Business Central Smartphone Client despite the general technological feasibility to do so.
- The technology used by NETRONIC is "touch enabled", but not "touch optimized". This means that the VSE can get used on Tablet PCs. However, not each (native) touch gestures will get supported.
- As HTML5/JavaScript client control add-in, the VSE requires Microsoft Dynamics 365 Business Central.

NETRONIC will not deliver a stand-alone application besides some code for demonstration purposes. The VSE comes with an API, which can get called in Microsoft Dynamics 365 Business Central via **AL code**. This interface can get used to provide data to the VSE and the VSE request actions by it.

3.2   Architecture

The general architecture of the VSE client control add-in is based on the following principles:

1. Other than in NETRONIC's standard Visual Scheduling Suite add-ins (such as the Visual Service Scheduler), NETRONIC will not manage data within the Gantt chart. All data management functions as well as the corresponding business logic happen within the Dynamics 365 Business Central database.
2. Nearly every mouse click on a graphical object (such as a Gantt chart bar, an order (etc.) in the table of the Gantt chart or a to be assigned allocation (etc.)) in the VSE client control add-in triggers a bi-directional communication between the VSE and Dynamics 365 Business Central (see "events" and "functions" in the graph below).
3. This bi-directional communication leads to an exchange of objects between the VSE and Dynamics 365 Business Central (see "objects" in the graph below).
4. An interactive change (e.g. movement in time) of an object inside of the VSE leads to a request for that change to Business Central. If the business logic of the customer application grants that request, an update of the respective object has to be done by a function call to the VSE with the changed data to finally carry out that change to the VSE.
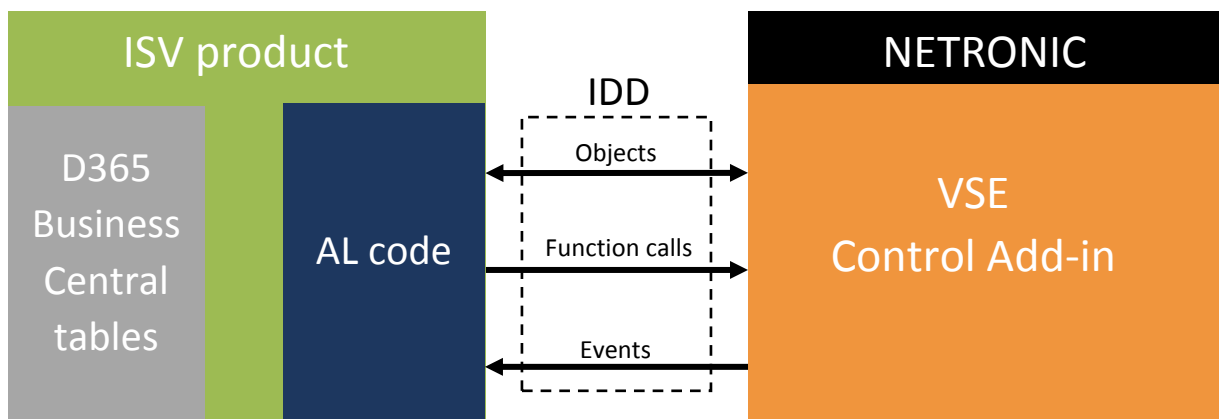
All required objects for the VSE client control add-in are defined and identified within the IDD. These objects, the functions and the events are part of a custom application programming interface (API) that can be addressed in Dynamics 365 Business Central via AL code. Via this interface the data are transferred/requested to/by the VSE.

3.3   Technological requirements

The VSE is developed based on HTML5/JavaScript program code. It can be performed using the respectively recent versions of the following browsers:

- Google Chrome (Windows)
- Microsoft Internet Explorer
- Mozilla Firefox (Windows)
- Apple Safari (iOS, macOS)
- Microsoft Edge (Windows)

In case of automatic software updates of these browsers, NETRONIC will update its base technology accordingly. However, NETRONIC cannot guarantee an any-time availability for any browser version. It is recommended by NETRONIC to use Google Chrome; at the day that this FDD is created, this browser achieves – by far – the best performance results.

4   Visualization

4.1   Views

The VSE consists of two views: the Resource View and the Activity View.

The **Resource View** allows an integrated view on the resources and their allocations. This view enables a re-allocation of activities from one resource to another resource and changes of the timing of allocations. It also allows to assign not yet allocated activities to resources.

The **Activity View** focuses the structure of one or more projects. It allows the time scheduling of activities within the project.

4.2   Resource View

4.2.1   General Building Blocks

The Resource View is built of the following elements for visualizing the respective data:

1. Table (Resources)
2. Timescale
3. Diagram area
4. Table (Entities)

This general structure is outlined below:

	2. Timescale	
1. Table (Resources)	3. Diagram area	4. Table (Entities)

Each building block of the Resource View is defined as follows.

4.2.2   Table (Resources)

The table area lists the resources. If a resource is sub-ordinated to another resource, it will be shown in an indented way in the table. The super-ordinated resource then also shows a symbol to collapse/ expand all its sub-ordinated resources. In case that a super-ordinated resource will get collapsed, the sub-ordinated resources will no longer get displayed. This enables a flexible nesting and grouping of different types of resources (e.g. employees to locations, replacement cars to garages, etc.).

The scope of evaluation purposes includes a one-column table only (e.g. to show one line of text which will be displayed to characterize the respective resource, incl. the above mentioned indentation and symbol to collapse/expand).

4.2.3   Timescale

4.2.3.1   Time range

The time range defines the date range that is shown in the current display of the VSE. This time range will be provided to the VSE as parameters from the application.

4.2.3.2   Timescale resolution

The horizontal resolution of the timescale can be adjusted by mouse wheel so that users can zoom in and zoom out of the displayed data in a seamless manner.

4.2.4   Diagram area

4.2.4.1   Visualization of resource calendars

The diagram area's background visualizes for each resource the work times (white) and non-work times (grey). This background calendar visualization cannot get changed interactively; it is just meant to display the general resources availability/ unavailability.

4.2.4.2   Visualization of resource allocations

The diagram area also shows the allocation of orders to resources as bars. The start and end date of a bar represents the time span in which the resource is allocated to that specific activity. If a resource has multiple allocations at the same time, the respective bars are shown one below the other.

Each bar can get a text to be displayed on it. The length of the bar determines the length of the text displayed (the text gets truncated at the end of the bar). Also, each bar can have a freely to be defined color. An application can define the display of the bar (text and color) flexibly and by their own via the respective data objects defined in the IDD.

Dependent bars (predecessor/ successor) and their links will be shown as a curved arrow line between the predecessor and the successor. An application can control which links will be shown when.

4.2.4.3   Curves/histograms

For each resource, a histogram can be shown that visualizes both the capacity and the utilization of that resource. The histogram is displayed in the same row in the diagram in which the resource itself is shown. It can get expanded/collapsed by the user via a click on a symbol in the table area. The histogram will be applied to the same time area that is valid for the entire diagram area and its scroll and zoom behavior corresponds with the time scale. The histogram can include two type of curves.

1) Capacity curve
   The capacity curve is shown as line and visualizes the total capacity of a resource at a given time.
2) Utilization curve
   The utilization curve visualizes the utilization of this total capacity at a given time and is shown as filled area between the zero-line and the respective utilization.

The values of these curves are set independently from the resources' allocations. This means that they are not automatically calculated based on the resources' allocations. This enables the ISV's application

to show these curves independent from the shown allocation and hence e.g. the "correct" allocation in case that some allocations had been filtered out.

In case the utilization curve exceeds the capacity curve, an overload exists. The overload area can get visualized by an own, independent color.

4.2.5   Table (Entities)

It is possible to show an additional table on the right side by option. This table can be filled with entity objects. If an entity is sub-ordinated to another entity, it will be shown in an indented way in the table. The super-ordinated entity then also shows a symbol to collapse/expand all its sub-ordinated entities. In case that a super-ordinated entity will get collapsed, the sub-ordinated entity will no longer get displayed. It is possible to drag and drop single entities from the table into the diagram area. This table can be used to show backlog activities.

4.2.6   Other Visual Elements

It is possible to show a set of information that will get displayed when the user hovers with the mouse over a graphical element (tooltip text). A graphical element in case of the VSE is defined as

- Resource in the left table area
- Bar in the diagram area
- Links in the diagram area
- Entities in the right table area

An application can define the different information sets per graphical element by their own, and will be enabled to change these information sets later independent from NETRONIC.

4.3   Activity View

4.3.1   General Building Blocks

The Activity View is built of the following elements for visualizing the respective data:

1. Table (Activities)
2. Timescale
3. Diagram area

	2. Timescale
1. Table (Activities)	3. Diagram area
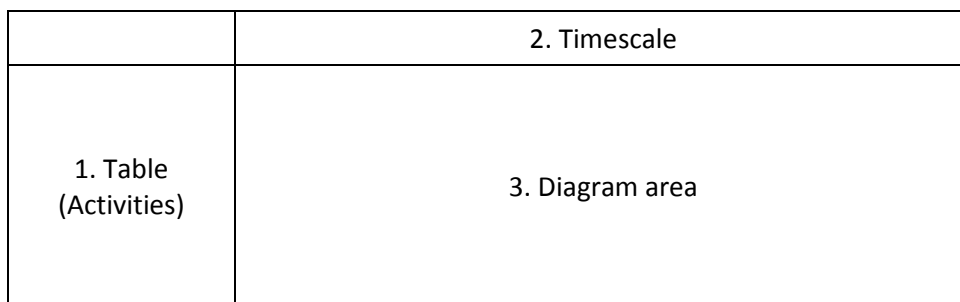
4.3.2 Table (Activities)

The table lists the activities. One activity can be the parent activity of other child activities. The super-ordinated activity is marked by a symbol in the table, which can be used to expand/collapse the underlying activities. If an activity is sub-ordinated to another activity, it will be shown in an indented way in the table.

The scope of evaluation purpose includes a one-column table only (e.g. to show one line of text which will be displayed to characterize the respective resource, incl. the above mentioned indentation and symbol to collapse/expand).

4.3.3 Timescale

The timescale is exactly as specified in the Resource View.

4.3.4 Diagram area: Visualization of activities

The diagram area shows activities as graphical objects. There are three different activity types resulting in three different visualizations:

Summary bar. The summary bar is typically used to visually embrace all subordinated activities. It spans the period from a given start date to a given finish data and will not be calculated automatically.

Activity. Activities are shown as bars. The time between the start and end date of a bar represent the duration of the activity. Each bar can have a text displayed on it. Also, each bar can have a freely defined color. The flexible creation of the bar display (text and color) can be done by an application via the respective data objects. The length of the bar determines the length of the text displayed: the text gets cropped at the end of the bar. It is also possible to define a percentage of complete for each activity, and to have an additional visualization of it.

Diamond. A diamond (often called milestone) is shown as a point of time symbol.

Dependencies between activities are shown as links between the bars.

4.3.5 Other Visual Elements

It is possible to show a set of information that will get displayed when the user hovers with the mouse over a graphical element (tooltip text). A graphical element in case of the VSE is defined as

- Activity in the table area
- Bar in the diagram area

5 Functionality: Drag & Drop Dispatching

The Resource View of the VSE visualizes allocations of resources and allows the user to change these allocations interactively via drag & drop.

5.1 Differentiation of user interaction

A visual scheduling application like the VSE typically supports the following graphical user interactions:

- Selection
- Movement
- Deletion
- Creation

5.2   Selection

5.2.1   Click

The user can select a resource, an allocation, an activity, or an entity.

This also triggers the events *OnSelectionChanged* which passes the ID of the selected object. This allows an application to react to this selection within Dynamics 365 Business Central accordingly by e.g. displaying a FactBox on the respective Business Central page with additional information.

5.2.2   Double click

The user can also double click on a resource, an allocation, an activity, a link or an entity. This triggers the events *OnDoubleClicked* accordingly including of the respective ID of the double clicked object. An application then can react to these events e.g. by opening the corresponding Dynamics 365 Business Central cards.

5.2.3   Right-click / context menu

The user can get enabled to open a context menu upon the right click on resource, an allocation, an activity, a link or an entity. The respective fitting context menus can be freely defined and associated with these elements by an application. If the user opens a context menu and selects an item, the event On*ContextMenuClicked* gets triggered. This event passes the object type and the ID of the respective object to the application. In addition to this, the ID of the context menu object and the index of the selected context menu item will get passed.

5.3   Movements: Change of allocations

These changes of allocations are allowed.

- Vertical movements = change of allocation from one resource to another (see above Visualization of resource allocations)
- Horizontal movements = change of start and date dates of an allocation
- Move of an activity from the entity table into the visual schedule to request the creation of a resource allocation
- Change of length of bar = change of duration of an allocation

All movements can get done with time-spot accuracy (on minutes- or even on seconds-level).

Once the user completed a movement, the VSE triggers an event and passes the respectively changed data to the Dynamics 365 Business Central application. This event is a request to change the data accordingly. An application can then react to this request with its own business logic, which then decides if the user's request gets approved, rejected or modified. In that way, the application can trigger an update call to the VSE which will then carry out the confirmed changes.

5.4   Deletion

An application needs to define if deleting information from the VSE should be possible and how this deletion should be treated in the underlying Dynamics 365 Business Central database.

5.5   Creation of objects

NETRONIC will not provide any functionality to allow the interactive and visual creation of a new object including the respective resource allocation. NETRONIC recommends that an application implements this functionality via buttons to be placed in the menu ribbon, which will be shown with the Dynamics 365 Business Central page that will contain the VSE.

6   API

Changes to the VSE can not only be executed via the user interactions specified in 5. In addition to this, they can also get triggered via program code calling API function (e.g. triggered by PageActions on a page).

There are additional functions to the add/update/remove functions related to the data objects, which can get applied to load and change data in the VSE. These additional functions can get used to

- Reduce the diagram area to a certain time interval
- Scroll horizontally to a specific time within the time area
- Scroll horizontally and vertically to a specific allocation in the diagram area
- Blend out all work-free periods, which all displayed resources have in common

7 Document change history

Version	Comment
1.0	Initial Document